

**INSTITUTE OF ACTUARIES OF INDIA**

**SUBJECT CA1 –Paper II**

**November 2010 EXAMINATION**

**INDICATIVE SOLUTION**

### Q.1 Solutions

Every aspect of the pension scheme administration will have to be looked into in order to minimise the cost.

#### **Benefit design**

- Keep minimum necessary benefit options.
- Same benefits for all employees – i.e. only 1 category
- Simple formula for all benefits if DB
- Have DC scheme rather than DB scheme
- The above will make the administration easier
- There will be less spent on employee education (explaining what benefit they are entitled to)
  
- Simpler benefit structure means
  - Lesser actuarial costs
  - Lesser management involvement
- If benefits can be paid as cash lumpsum instead of as pension. Admin cost would be lower of both payment as well as maintaining records for a longer period of time.
- More so if the amount of benefit is going to be very small. Cost of benefit payment can be reduced.

#### **Admin Cost**

- Use standard documentation of similar schemes; this would reduce the legal and scheme approval costs
- Only do minimum required by legislation in terms of disclosure, accounting or valuation work
  
- Contribution paid through automatic salary deduction; reduces the payment processing expenses
- Have an efficient and cost effective administrative systems
- Train the staff well
- Where possible use existing staff (eg payroll or personnel) – don't take on new staff
- Use emails or intranet to communicate to staff about any benefits/ options etc. Would be cheaper than sending printed material to each one of them

#### **Outsourcing**

- The employer is large so most routine stuff can be handled internally
- However specialist tasks such as investment or benefit payments (eg need details on ex-employees) could be outsourced
- It may also be cheaper to use specialist professional consultants eg lawyers or actuaries rather than employing them directly

#### **Controls**

- Prepare a budget;
- Monitor expenses against budget;
- Keep tight control on expenses of running the scheme
- Take quick action on expense overruns

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## Q2. Solution:

- (a) A good model should
- (i) Should be valid, rigorous for its purpose and adequately documented
  - (ii) Should be capable of reflecting all the risks in the products or contract being modeled
  - (iii) Parameters and inputs for the parameters used must allow for all those features of the business being modeled
  - (iv) Also should take care of the economic and business environment in which it is operating
  - (v) Working of the model should be easy to understand and communicate
  - (vi) Should be well tested
  - (vii) Output should be capable of independent verification
  - (viii) Should not be overly complex
  - (ix) Should not be expensive to run
  - (x) Should not be time consuming to run
  - (xi) Should be capable of development and refinement
- (b) Steps involved in deterministic model are:
- (i) Specify the purpose of investigation
  - (ii) Collect, group and modify data
  - (iii) Choose the form of model, identifying its parameters and variables
  - (iv) Ascribe values to the parameters using past experience and appropriate estimation techniques
  - (v) Construct a model based on expected cash-flows
  - (vi) Check the goodness of fit
  - (vii) Attempt to fit a different model if the first choice does not fit well
  - (viii) Run the model using selected variables
  - (ix) Run the model several times for sensitivity testing of results to various parameters

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## Q3. Solution:

- (i) Competent team of the project is very critical, including who is leading it.
- (ii) It should be individuals who have a complete idea of how to drive this project
- (iii) Identification of the project sponsors and the project management team, and communication to all the concerned
- (iv) Project managers should have the experience and authority to take decisions
- (v) Written objective and strategy to achieve the objectives should be there
- (vi) The same should be circulated to all the key stakeholders in the project
- (vii) Detailed project plan should be in place
- (viii) There should be clear responsibilities defined for each member and the same should be clearly communicated
- (ix) Through risk analysis
- (x) Constant monitoring the development and objective measures of performance and quality standards

- (xi) Need to ensure the project moves at an appropriate pace
- (xii) Should use tools like critical path analysis
- (xiii) the right people do the right things at the right time
- (xiv) Should be able to use suitable external resources as well.
- (xv) Key mile stones to be reviewed
- (xvi) Regular and clear communication needs to be there between all the relevant parties
- (xvii) Budget has to be set and costs measured against the budget at regular intervals
- (xviii) Technical and design changes should be avoided once implementation has begun.
- (xix) Strict change control management should be implemented.
- (xx) Any new technology should be fully tested before being released for use.
- (xxi) At these milestone review points, critical questions on all aspects of the project should be raised by all those involved in the project.
- (xxii) Good conflict management

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Q4. Solution:

- (a) Problems the company might face in the long run are:
  - (i) Company's image will take a hit
  - (ii) If proprietary, then the share prices of the company might go down. However it may have already moved. But in any event, the announcement is likely to have an impact.
  - (iii) Fixed expenses would be spread over a reducing number of policies. Extra expense will be involved in dealing with the regulator and bringing in a recovery plan e.g. use of consultants, management time.
  - (iv) This could be aggravated by large surrenders which may happen. The earlier surrender factors may be generous, so will need work out new surrender factors.
  - (v) Because of higher surrenders, there would be an impact on the investment strategy, will need to maintain higher liquidity.
  - (vi) There could be regulatory requirement to send communications to these customers about their options; eg surrender penalties or deferring the surrender payments, etc.
  - (vii) There would be costs of stopping new business; they will have to move from bigger premises to smaller premises, will have to cut down on staff, keeping only minimum staff to administer the existing policies
  - (viii) Much would depend on the extent of the failure e.g if the statutory basis is very strong and the real position may not be too bad and things can be put right quickly
  - (ix) Investment will be restrictive; as the funds are shrinking also the guaranteed portions will be a larger proportion of the benefits
  - (x) Bonus philosophy will need to change along with the change in investment policy
  - (xi) Need to communicate to the policyholders in order to realign the PRE
  - (xii) It would be difficult to rebuild the confidence of the intermediaries or ever write new business again if the future premium rates have to rise.

## (b) Recovery plan

- I. Change in investment strategy
  - (i) Invest in less volatile assets: probability of meeting the liability will increase
  - (ii) Match assets and liabilities; there will be no need to keep mismatching reserves
  - (iii) Invest in only allowable assets e.g. govt. securities, only domestic investments, only quoted investment, no self investment
  - (iv) Divest out of illiquid assets (as liquidity might become important in a running down situation)
- I. Increasing the amount of reinsurance
  - (i) This reduce the claims volatility
  - (ii) Solvency requirement would reduce with reinsurance
  - (iii) Reinsurance can be used as alternate source of capital
- II. Closing to new business in a way might be fine, as new business initially creates NB strain, which will need capital.
- III. Cutting costs i.e. less staff, less capital investment, defer projects
- IV. Cutting bonus payments
- V. Toughen claims underwriting
- VI. Seek an injection of capital
- VII. Sell parts of the business or other assets e.g. property

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Q 5. Solution:

(a)

The three components of market risk involved in the construction of a portfolio are

**Strategic Risk**

An appropriate asset mix for the fund will need to be established – the strategic benchmark. The strategic (or policy) risk of the fund is the risk of poor performance of the strategic benchmark relative to the value of the liabilities.

**Active Risk**

The strategy can be implemented by the selection of one or more managers, and a decision on the appropriate level of risk that these managers should take relative to the strategic benchmark. This is known as the active (or manager or implementation) risk.

**Structural Risk**

There may also be some structural risk associated with any mismatch between the aggregate of the portfolio benchmarks and the total fund benchmark.

(b)

- Nature - The liabilities are mainly real in nature,  
with claims linked to inflation – price inflation and salary inflation (third party claims)
- Uncertainty-There is uncertainty associated with the timing and amount of the claims payments.
- Currency -The liabilities are likely in the domestic currency.
- Term- Apart from third party cover all other liabilities are likely to be short term.

#### Appropriateness of Index-linked government bonds

- These provide a real return, which is appropriate to the real nature of the insurance company's liabilities (as both the claims payments and expenses are real).
- Given the short-term nature of the liabilities, some short-term fixed-interest bonds may be considered a reasonable match for real liabilities, as the risk that inflation is higher than expected over the short term is small.
- However, the claims relating to third party liabilities will increase in line with salary inflation as well as court awards and precedence. Salary inflation, court awards may be expected to exceed price inflation.
- Index-linked government bonds are lower risk (default / volatility), and correspondingly tend to offer lower expected returns than other real asset classes, eg equities. Equity investments may provide a better match for third part liabilities considering these liabilities are more long tailed and offer a better protection against salary, court inflation.
- However, the company may not want to hold naked exposure to equities due to P and L volatility and solvency issues. , especially since the company is small, and may not have sufficient free assets with which to absorb the volatility. Hence a suitable simple hedging strategy should be considered to protect against fall in equity values.
- Expenses of the organization- a large part of the liabilities for expenses will be salary related and salary inflation tends to exceed price inflation. Hence index linked are not ideal for covering expenses but are adequate
- There may be problems with Index linked bonds due to supply and demand eg limited supply forces up prices making them more expensive and so reducing potential returns. Regulations may require strict matching so making them the most appropriate.

Cash instruments are appropriate as -

- Cash instruments provide a good match to the short term portion of the liabilities.
- Cash instruments also provide liquidity, enabling the insurance company to pay unexpected claims without forced sale of assets.
- Cash instruments are a secure investment, having a low risk of default.
- The returns on cash instruments may provide a degree of inflation protection as short term interest rates tend to move in line with inflation.
- Short-term investments such as cash offer stable monetary values. This may be useful as the insurance company is small and may be more worried about random variations in its P and L and hence solvency position.
- Cash may be suitable if the company expects other asset classes to perform badly, eg if the company anticipates a recession or an interest rate rise ahead of the market.  
However, there are negatives associated with cash investments –
  - relatively low returns
  - cash is too short for much of the liability ie there is a reinvestment risk so short bonds may be better (though some cash instruments may be available for 1 year duration as well- term deposits).
  - To boost returns overseas cash could be an option but there are risks.

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Q6. Solution:

(a) Cashflows under

Option 1:

**Reducing loan**

- Loan amount received upfront
- Regular payment of equated monthly installment (emi), which is used to partly repay the principle
- So the principle outstanding decreases
- Usually loans are given under floating rate interest, so the outstanding principle at each point is not known in advance
- If so, a change in interest rate implies a change in the repayment amount (up or down) so as to ensure the loan is paid off by the end of the term
- The person can also pay higher amounts and hence the loan can get repaid earlier.

**Decreasing term assurance**

- The aim is that on death before the end of the term, any outstanding capital is covered by the policy
- Known amount of premium payable at regular intervals till end of premium paying term or earlier death
- Most decreasing term assurance policies have premium paying term shorter than the policy term, usually  $2/3^{\text{rd}}$  the policy term.

- The sum assured would be sufficient to repay the outstanding loan only if the loan schedule and the term assurance schedule are exactly matched, else there could be shortfall or excess.
- It is usually likely to have a mismatch (if the loan is under floating rate interest), as the repayment schedule is unknown upfront.
- Hence, premiums may be altered if interest rates rise (to avoid shortfall) or fall (to avoid an excess).

Option 2:

#### **Interest only loan**

- Loan amount received upfront
- Only interest payment to be made
- So the outstanding capital remains fixed during the term
- Interest rate usually would be on floating rate basis, hence cashflows may not be known upfront

#### **Endowment**

- Known amount of premium payable at regular intervals till end of the term or earlier death
- The aim is that on death or at maturity, the sum assured under the policy will cover the outstanding capital
- This will only happen if the sum assured on maturity or earlier death is equal to the loan amount.
- If the endowment is without profit, this match can be achieved.
- If endowment is with profits or unit linked then there is a possibility of a shortfall or an excess on death or maturity.
- Some policies may give a fixed death benefit equal to the loan with a variable maturity amount expected (i.e. priced) to be in excess of the loan so adding in a savings element and reducing risks
- It may be possible to repay the loan before the end of the term, only if there is enough surrender value.

(b)

The advantages

- more profit margin on a tied policy
- It is more likely that the loan will get repaid even in case of the borrowers untimely death
- It maybe what consumers want ie easier for them implies more business

The disadvantages

- having to pay compensation if the policy is missold (i.e. not what was best for the customer)
- bad publicity or loss of business if high expenses are investigated
- The process of the insurance policy issuance (say underwriting) should not be so cumbersome that the person decides to take the loan from somewhere else. That is the whole process may put people off



- (c) The main disadvantage would be that in case of the person's death before the tenure of the loan, there would be a short fall.  
But the shortfall will decrease with time since the capital outstanding is reducing so especially for young lives (*lower death risk*) this may not be great issue.

If the loan can't be repaid, the bank can sell the house to cover it – so only a real problem at short durations

The bank could increase interest rates on loans with no insurance cover or only lend an amount well below the value of the house.

**[14]**

Q 7. Solution:

- (a) A fundamental review implies the company is looking at the impact of this business on its financial position and whether things can be improved. In particular:
- (i) To ascertain the profitability of current premium rates
  - (ii) To ascertain the profitability of new proposed premium rates
  - (iii) To analyze segment level profitability of the premium rates
  - (iv) To compare with premium rates with competitors
  - (v) To investigate the expected to actual experience of this portfolio
  - (vi) To review the current rating structure and suggest any new rating factors
  - (vii) To assess the impact of changes in cover or other terms and conditions
  - (viii) To assess the effect on market share if the product was re-priced
  - (ix) To look at the appropriateness of any expenses loadings and are actual expenses being covered
  - (x) To assess any premiums being charged by reinsurers
  - (xi) To assess the extent of cross subsidies
- (b) Why can't we use the past data directly
- (i) Firstly it is not clear how credible the data is, if the data is too few then it would not be correct to completely rely on the past data. Only 10 yrs of past data. Number of death may not be a lot and certainly not enough in all the homogeneous subgroups.
  - (ii) Underwriting practices could have changed
  - (iii) Changes in the nature of scheme retirees e.g different ages, occupations or due to illhealth e.g concentrations on big early retirement exercise
  - (iv) Underlying mortality rate itself could have changed due to medical advancement or onset of a new disease, etc.
- (c) Why not the standard table
- (i) Standard table would have been made using data of many companies or based on general population mortality

- (ii) So they may not be suitable for direct use for any one company. Really want similar companies in terms of business. In particular business from schemes and not personal policyholders
  - (iii) They are likely to be outdated. Probably based on historic data whereas we want future mortality. In any event any projections used for the future may be wrong.
  - (iv) Data errors in individual companies would have crept into industry data
  - (v) Underwriting practices of different companies could be different, so all those effects would compromise standard table
  - (vi) Standard table would be mainly “death rate” table but is unlikely to be the experience of only occupational annuity products. The mortality experience on occupational annuities are expected to be different from that on a voluntary purchase annuities.
  - (vii) There may not be enough data to use in the groupings we need e.g. mortality depends on duration from retirement or other select issues (non-disclosure of good health).
- (d) Alternative sources
- (i) We may try to cover any other annuity business that this company writes eg personal lines
  - (ii) Industry data either from competitors offerings similar products or from pension scheme sources
  - (iii) Reinsurer’s can help in such a situation
  - (iv) All the above will have to be adjusted to suit to the current/ future requirement. In the above cases, adjustments will be needed to suit the fact that we require views on future mortality both in terms of deaths in the future and new retirees in the future
  - (v) From National statistics from government or even similar overseas data

[14]

Q8. Solution:

a) Before providing advice the consultant should consider

- Whether he has the necessary qualification and experience to provide the advice. Since this work is suppose to give an assurance to the AA the consulting actuary should necessarily be a peer/senior to the AA, in terms of experience
- Avoid conflicts of interest- Conflicts could arise if the consultant is advising more than one associated party or from within the insurance company Conflict could also arise is the consultant is a policyholder, shareholder of this or rival companies ie is he truly independent
- Whether he has good knowledge and understanding of local laws, regulations, and professional guidance notes, accounting norms and ability to interpret the various laws and regulations.
- As a part of the assignment the consultant will be in possession of confidential information/data eg price sensitive information. This information should be handled in an appropriately secure way.

*All points carry ½ mark unless otherwise stated*

b)

#### Process of Data Collection and Verification

- Data governance structure, QC measures in place to ensure that data is captured in Policy administration is accurate and that adequate controls are in place to ensure data integrity;
- How is data extracted from policy administration system for the purpose of valuation- through a query, direct feed to the valuation system;
- What are the checks that are done on the data to ensure its completeness and accuracy, for eg., are the following done-
  - On and OFF movement report- from last year valuation by No of policies, SA and Premium Income, no of units in respect of unit linked policies.
  - In respect of unit linked policies reconciliation of unit balances and fund values with Investment department's asset balances in respect of each fund
  - Verification with account department on claim payments-deaths, surrenders, maturities.
- Has reasonable checks done on data to ensure no "dumb" values, off-track premiums and SA, incorrect date of birth, irrelevant policy status etc. How are they corrected and used in valuation,
- Once extracted from policy administration system is there any manual interfaces and correction on the data and if yes, is an adequate doer/checker process in place and are there adequately documented.
- Has sufficient data been collected to value all benefits fully or to reasonable degrees of approximation

#### Reasonableness valuation assumptions

##### In respect of non financial assumptions

- Sources for assumptions if not using own data and if own data is adequate eg big changes in nature of business etc
- Review of recent experience analysis conducted- mortality/morbidity, lapses, expenses, expense inflation in respect of major product groups
- Credibility of current experience,
- Understanding of major reinsurance treaties that the currently has in place- rates, terms and conditions.

- Non financial Best estimate assumptions proposed and level of margins for adverse deviations along with their justification. How does it compare with existing regulations? Are there any specific basis/approach required under regulations relating to lapse, surrender assumptions
- Change in any assumption compared to previous valuation and reasons for the same

In respect of financial assumptions-

- Current asset mix for each of the existing asset pools. If a common pool of assets is managed how are the assets allocated to various products groups (Single premium vs, Regular premium)
- Whether actual or notional assets are used to determine assumptions.
- What are the existing regulations relating to valuation interest rate assumptions eg do they recommend running yield, risk free rate etc. and how does it compare with assumption used etc.
- Are the financial assumptions deterministic/stochastic and if stochastic variables are used – are they consistent with experience and regulations. If deterministic variables are used have any sensitivity/scenario analysis been performed to determine impact of adverse scenarios
- Does the investment approach involve risk and whether there is an allowance for risk in the assumptions? This also relates to how far managers can and do deviate from the benchmark and the implications thereof.
- Level of credit risk in the portfolio, asset defaults, if any,, in the past and how is the same allowed for
- Portfolio performance on statutory basis for the last year/s
- Asset and liability cash flows and the level of mismatch.
- Proposed Best estimate assumption, margins for adverse deviation and reasons for the same, adequacy compared with required minimum

Method adopted for valuation of policy liabilities

- How is the valuation done- on a policy by policy basis or grouped, if so, is the grouping representative enough of the underlying policies
- What is the valuation system, model governance structure, change management system, how are models maintained, checked and verified to be appropriate for the purpose of valuation.
- What is proposed method of valuation –cash flow, formula based? Are any approximations used
- Is the proposed methodology in compliance with existing regulations? For example in relation to any allowance for future premiums or bonuses (accrued and expected)
- In respect of products with discretionary benefits, how are the discretionary benefits allowed for in valuation, is it a fair reflection of management behavior and does it meet PRE

- Valuation of options and guarantees- significance, methodology of valuation, models, parameters,
- Are there any global reserves proposed to be held- catastrophic, Birds Flu, etc.
- Is there any change in methodology compared to previous valuation

#### Reasonableness of results

- Are independent checks performed to assess the reasonableness of the results- back of the envelop movement of reserve calculation ie a rough reconciliation from the previous result (for eg.  $\text{Previous closing reserve} \times (1 + \text{valint}) + \text{Premiums} \times (1 + \text{valint}/2) - \text{actual claims} - \text{expenses} = \text{closing reserve}$ )
- Fund Movement in respect of UL products- recon with Inflow, outflow and investment income
- Crucial ratios like average reserve per policy calculated and if they look reasonable. Are the crucial ratios consistent with last year and can movements be reconciled.
- Attribution analysis- Split of reserves into its various components- PV of premiums, PV of expenses, PV of benefits etc. and comparison with last year.
- Are results consistent with industry trends or competition?

[20]

[Total Marks 100]

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